Screening Mammography Capacity
Objectives

- Examine the adequacy of mammography facilities to meet HP 2010 goals
  - County-level
  - 14 states in the South
- Compare breast cancer screening rates, stage of disease at diagnosis, and breast cancer mortality rates of women who live in counties with and without adequate screening facilities
  - Person level
- Project mammography facilities needed to meet HP 2020 goals
Percent of Population in Poverty
All ages by County, 2010

Note: Alaska and Hawaii not shown to scale.
Health Insurance Coverage Status
Percent Uninsured in 2010 by County

Source: U.S. Census Bureau, 2010 Small Area Health Insurance Estimates (SAHIE) program.
Map produced by Center for Applied Research and Environmental Systems (CARES); September, 2012.
Data Sources

U. S. Census
- Age
- Income
- Poverty
- Education
- Race
- Ethnicity
- Language
- Insurance
- Transportation

BRFSS

Mammography Facility in County or Adjacent County

FDA

Rates of Stage 0 - Stage IV

State Cancer Registry

Mammography Screening Rate

Mortality Rate
HP 2010 & 2020 Goals

- HP 2010 Goal = screen 70% of women over age 40 every 1-2 years
- HP 2020 Goal = screen 81.1% of women over age 50 every 1-2 years
Capacity Definitions

• GAO: One mammogram machine can perform 6000 mammograms/year
  3 mammograms/hour, 8 hrs/day, 5 days/week, 50 weeks/year

• Therefore... 1.7 machines/10,000 women = capacity to screen 100% of
  women annually

• 1.7/2 = .85 machines/10,000 women = capacity to screen 100% of
  women biennially

• .85 machines * .70 (HP 2010 goal) = .595 machines/10,000 women =
  Adequate Capacity to reach HP 2010 goal

• Machine density = machines/women * 10,000
Percent screened within 2 years
Women over age 40

- No capacity, all yrs
- Inadequate capacity, some or all yrs
- Adequate capacity, all yrs

Year | No capacity | Inadequate capacity | Adequate capacity |
--- | --- | --- | --- |
2000 | 70% | 75% | 90%
2002 | 65% | 80% | 95%
2004 | 60% | 85% | 100%
Percent screened within 2 years
Women over age 50

![Bar chart showing percent screened within 2 years for women over age 50 in 2000, 2002, and 2004. The categories include: No capacity, all yrs, Inadequate capacity, some or all yrs, and Adequate capacity, all yrs.](chart_image)
Factors associated with Screening Mammogram within 2 years – women over 50 years

<table>
<thead>
<tr>
<th>Factor</th>
<th>Odds Ratio</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residence in county with adequate facilities 2 years prior to interview year</td>
<td>1.19</td>
<td>1.13, 1.25</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Black</td>
<td>1.12</td>
<td>1.02, 1.24</td>
<td>0.02</td>
</tr>
<tr>
<td>Hispanic</td>
<td>1.11</td>
<td>0.94, 1.30</td>
<td>0.22</td>
</tr>
<tr>
<td>Usual care provider</td>
<td>4.55</td>
<td>4.1, 5.0</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Health insurance</td>
<td>2.52</td>
<td>2.27, 2.80</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Poor self-reported health</td>
<td>0.59</td>
<td>0.54, 0.65</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Age</td>
<td>0.97</td>
<td>0.97, 0.96</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Recently deferred care due to cost</td>
<td>0.56</td>
<td>0.5, 0.62</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
### Rates of Diagnosis at Stage 0 = IV

<table>
<thead>
<tr>
<th>Stage at Presentation</th>
<th>Inadequate or No Capacity Rate/100,000 women</th>
<th>Adequate Capacity Rate/100,000 women</th>
<th>Risk Ratio</th>
<th>P value</th>
<th>Attributable Fraction Sample</th>
<th>Attributable Fraction Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>In situ</td>
<td>246</td>
<td>273</td>
<td>0.89</td>
<td>&lt;0.001</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>Local</td>
<td>956</td>
<td>962</td>
<td>0.99</td>
<td>0.6</td>
<td>1</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Regional</td>
<td>461</td>
<td>457</td>
<td>1.01</td>
<td>0.5</td>
<td>1</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Distant</td>
<td>87</td>
<td>79</td>
<td>1.10</td>
<td>0.005</td>
<td>9</td>
<td>1</td>
</tr>
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# Factors Associated with Diagnosis at Stage IV

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<tbody>
<tr>
<td>Residence in county with <strong>inadequate or no capacity</strong></td>
<td>1.19</td>
<td>1.13, 1.25</td>
<td>0.03</td>
</tr>
<tr>
<td>Black</td>
<td>1.80</td>
<td>1.70, 1.90</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Hispanic</td>
<td>0.96</td>
<td>0.95, 0.97</td>
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<tr>
<td>Age</td>
<td>1.003</td>
<td>1.002, 1.005</td>
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Number of additional machines needed to meet Health People 2020 targets through 2025
Conclusions

Inadequate screening mammography capacity is associated with lower screening rates and higher stage of disease at presentation.

Significant investment in additional machines will be needed throughout the South to achieve HP 2020 goals.
Kaplan-Meier survival estimates

Age-adjusted

cap_adequate50_yr2prior = 0  cap_adequate50_yr2prior = 1
Conceptual Framework

Mammography Facility in County or Adjacent County

Mammography Screening Rate

Rates of Stage 0 - Stage IV

Mortality Rate

Age
Income
Poverty
Education
Race
Ethnicity
Language
Insurance
Transportation
# Cox model

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<tr>
<td>Age</td>
<td>1.027</td>
<td>1.026, 1.028</td>
<td>&lt;0.001</td>
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<tr>
<td>Stage IV</td>
<td>3.52</td>
<td>3.40, 3.64</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Tumor &gt; 5 cm</td>
<td>2.08</td>
<td>2.01, 2.15</td>
<td>&lt;0.001</td>
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Conceptual Framework

Mammography Facility in County or Adjacent County

Mammography Screening Rate

Rates of Stage 0 - Stage IV

Mortality Rate

Treatment

Age
Income
Poverty
Education
Race
Ethnicity
Language
Insurance
Transportation
If too few machines is bad, what about too many machines? Over-screening? Over-diagnosis?

Excess machines = more than the number needed to screen 100% of women over 50 biennially + 15% for second views
### Rates of Diagnosis at Stage 0 = IV

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Women in 14 Southern states
Time since last mammogram – 2000
All women over 40 yrs of age in US

- Can't remember
- 5yr or more
- 4yr
- 3 yr
- 2 yr
- 1 yr
- Never
Time since last mammogram – 2010
All women over 40 yrs of age in US
Time since last mammogram – 2010
Self-reported health = fair or poor
Time since last mammogram – 2010
All women over 40 yrs of age in US
Time since last mammogram – 2010
Self-reported health = fair or poor

[Bar chart showing the number of women in different age groups and time since last mammogram, grouped by health status and mammogram frequency.]
Time since last mammogram – 2010
All women in US - 80 – 99 years of age
Time since last mammogram – 2010
80 – 99 years of age

Excellent - Good Health
Fair or Poor Health

Can't remember
5yr or more
4yr
3 yr
2 yr
1 yr
Never
Are screening practices in the elderly related to mammography capacity?
Percent with mammogram within last 2 years 2000 - 2004

Women >40
Women >80
Fair/Poor Health & >80

Women in 14 Southern states

Categories:
- No Facilities
- Inadequate Facilities
- Adequate Facilities
- Excess Facilities
Characteristics of County Populations – Median Family Income

Women in 14 Southern states

Median Income

- No Facilities
- Inadequate Facilities
- Adequate Facilities
- Excess Facilities
Characteristics of County Populations - Economic

Women in 14 Southern states
Characteristics of County Populations – Education, rurality

Women in 14 Southern states

- % HS graduate
- % English
- % rural

Legend:
- No Facilities
- Inadequate Facilities
- Adequate Facilities
- Excess Facilities
Characteristics of County Populations

Women in 14 Southern states

- % non-White
- % Black
- % Hispanic

- No Facilities
- Inadequate Facilities
- Adequate Facilities
- Excess Facilities
Screening mammography among elderly women with fair-poor self-reported health seem to be related to mammography capacity...

But not in the way we might predict.

The association may be more suggestive of local/regional practice patterns in affluent, well-educated, predominantly white suburban areas.

Any brilliant thoughts about the next step??